into account the three linear dimensions of the fabric, and for this purpose, we have only to apply a similar mode of reasoning, and a similar process of variation, to the cube considered as a basis, which Palladio adopted for the square, since this figure bears precisely the same analogy to solid bodies that the square does to plane surfaces, each of them being made the measuring unit of their respective species of magnitude.

Thus modified, the seven varieties of proportion which constitute the subject of the present paper become—

No. 1—1, 1, 1, corresponding to the perfect cube.

No. 2—1½, 1, 1, corresponding to the perfect cube and its half.

No. 3—2, 1, 1, corresponding to the double of the perfect cube.

No. 4—3, 2, 1, corresponding to six perfect cubes.

No. 5—4, 3, 2, corresponding to twenty-four perfect cubes.

No. 6—5, 4, 3, corresponding to sixty perfect cubes.

No. 7—6, 4, 3, corresponding to seventy-two perfect cubes.

Now, in all these varieties of proportion, it must be understood, that the first term respects the length of a room or other compartment of a building, whether considered internally or externally; the second term has reference to the breadth, and the third to the height, the terms themselves merely indicating the proportion of the parts, the actual dimensions being the same equimultiples of each variety, or the arithmetical harmonies of the respective terms. These analogies, therefore, comprehend the whole doctrine of Architectural proportion; for, whatever may be the nature of the building, the relation of its parts will always be represented by the terms of the analogy employed, according to the value of the base or radical dimension of the building given.

Thus, for example, if we suppose the length of a building to be 54 feet, and the analogy of construction to be 6, 4, and 3, corresponding to No. 7 in the foregoing tablet, then we get 54 for the length, 36 for the breadth, and 27 for the height, the breadth and height being obtained from the given length in the following manner:—

6 : 4 : : 54 : 36, the breadth.
6 : 3 : : 54 : 27, the height.

Or if 54, the given length, be divided by 6, the corresponding term in the given analogy, the quotient 9 will be the greatest common divisor of the three dimensions; and if each term of the radical proportion be multiplied by the greatest common divisor, the products will be the required dimensions of the building, considered as a whole, or of any specified compartment thereof; thus we have—

6 × 9 = 54, the length of the building.
4 × 9 = 36, the breadth of ditto.
3 × 9 = 27, the height of ditto.

And the same process applies to the consideration of the rooms, and other subdivisions of the entire fabric.

The above is the method of assigning the dimensions of a room or building corresponding to a specified proportion, and it is easy to perceive, that the same process will apply in the case of any other proportion, whatever may be the name of the given dimension assumed as the radix of calculation, provided that we employ the corresponding term of the specified analogy to determine the greatest common divisor of the required dimensions.

Thus, for instance, if we suppose the breadth of a room to be 28 feet, and the analogy of construction 5, 4, and 3, as in No. 6 of the foregoing tablet; then the length will be 35 feet and the height 21; for 28 divided by 4 quotes 7 for the greatest common divisor, from which we get

5 × 7 = 35, the length of the room.
4 × 7 = 28, the breadth of ditto.
3 × 7 = 21, the height of ditto.

Again, suppose the height of a room to be 18 feet, and the analogy of construction 4, 3 and 2, as in No. 5 of our tablet; then will the length be 36 feet and the breadth 27; for in this case the greatest common divisor is 9, from which we get

4 × 9 = 36, the length of the room.
3 × 9 = 27, the breadth of ditto.
2 × 9 = 18, the height of ditto.

It would be an excellent way of exemplifying the beauty and utility of the seven proportions given above, whether as applied to an entire building, or to some compartment of it, to exhibit a plan and elevation as deduced from each of them; this, however, would extend the present paper to too great a length, and occupy too much of the writer's time, but it would be valuable exercise to the students of architecture, inasmuch as it would fix the principles firmly in the mind, and satisfy them as to the correctness of the several analogies adopted, which probably will not be so readily admitted without some kind of graphic illustration.

What we have hitherto done, has reference only to the proportions that ought to obtain in the dimensions of rooms, when considered independently of the general form of the building, and the proportions that ought to obtain in the dimensions of the building itself when considered as an independent whole. We have, therefore, in the next place, to inquire what ought to be the dimensions of the doors, windows, and other openings, to admit a sufficient quantity of air and light for the supply of apartments constructed on the principles of the foregoing analogies.

Since nature has established certain rules for giving to buildings the just and proper proportions, so also has theory established rules and maxims for proportioning the quantity of light to be admitted, according to the magnitude of the space to be illuminated. It is not necessary in this place to trace the steps of investigation which have led to the discovery of the rules and maxims here alluded to; this would carry us far beyond the subject of the present communication, and claim the aid of a higher calculus than would be consistent with the object we had in view, when the idea of this discussion first presented itself; we shall, therefore, waive the investigation, and content ourselves with simply propounding the practical rule by which the quantity of opening is to be obtained, for any proposed dimensions of the space to be illuminated. The practical rule for the quantity of opening is as follows:

Multiply the three dimensions of length, breadth, and height together, and the square root of the solid thus produced will be the superficial content of the opening required for light.

As an example of the application of the rule, we shall take the first of the preceding cases, where the length is 54 feet, breadth 36 feet, and height 27 feet; these numbers being in the proportion of 6, 4, and 3, agreeably to No. 7 of the natural scale.

The product of the three dimensions is, 54 × 36 × 27 = 729 × 72 = 52488, and the square root of this is $\sqrt{52488}$ = 229·12 square feet. Now, since the length of the room is 54 feet, we may suppose that it contains five windows in the tier; therefore, if the above root be divided by 5, we get 229·12 ÷ 5 = 45·824 square feet for each window.

A very common and a very just proportion for doors and windows in the principal rooms of large dwelling-houses is that of two diameters, or where the height is twice the breadth; we have, therefore, to convert the square 45·824 into a rectangular parallelogram, in which the one side shall be double of the other, and for this purpose we have only to divide the given quantity by 2, and extract the square root of the quotient for the breadth or least dimension of the window, and the double of this will accordingly be the height thereof.

Thus we have $\sqrt{45·824 \div 2} = \sqrt{22·912}$ = 4·786 feet, the breadth of each window, and 4·786 × 2 = 9·572 feet, the corresponding height. It is not necessary to adduce more examples for the illustration of this part of the subject, for the application of the rule is so easy, that there can be little danger of even the most superficial calculator falling into error. But here, as in the foregoing department of the inquiry, we strongly recommend a graphic delineation of the room and the windows, in order the more fully to appreciate the value of the rule itself, and the correctness of the proportions employed in its production.

The third and last part of the subject relates to the determination of the proper dimensions of fire-places and chimney-flues, so as to obtain a proper degree of heat and ventilation, according to the quantity of space proposed to be ventilated. This is indeed a very important branch of practical architecture, and has of late acquired additional interest, in consequence of the dispute that has arisen between Mr. Barry and Dr. Reid, in regard to the mode of ventilating the new houses of parliament. The whole doctrine, however, is contained in a nutshell, and the desired object can easily be effected, without having recourse to the refined artifices which modern science has brought to bear upon it. The rules which nature supplies for working out her own economy are invariably general in their principles and simple in their operation; and, if practical men could only be induced to follow those rules, many of the difficulties which operate to retard the progress of improvement would be found to disappear. T.

*** This theory was propounded and treated at considerable length by Robert Morris, in "Lectures on Architecture, consisting of rules founded upon harmonick and arithmetical proportions in Building," 1736.

PRESERVATION AND METALIZATION OF WOOD.

A patent for improvements in the mode of preserving wood has been taken out in France, by Mr. Banner. As in what is called Payne's process, the air is extracted from the pores of the wood, and solutions of metallic oxides, producing "by their combination another insoluble substance resulting from a double decomposition," made to take its place. The following is a portion of the patentee's specification.

"1. The chemical agents are composed by the employment of a saturated solution of sulphate of iron, in the proportion of 5 oz. 3 dwts. to 1 quart; that is to say, having a specific gravity of 1,756 to the temperature of the atmosphere.

2. The employment of a saturated solution of muriate of lime, having a density to the ordinary temperature of the atmosphere of 2,344, or 27 oz. 7 dwts. to 1 quart. I declare that my improvements consist in the following preparations, and I claim them as being my exclusive property and invention; namely—1,000 lbs. of brass filings should be placed upon a table or bench so as to form a conical heap. I moisten this mass or heap with a solution of sal-ammoniac (muriate of ammonia), composed of 24 lbs. of salt upon 200 lbs. of water, when a certain chemical action commences to manifest itself, which is rendered visible by the escape of the ammonia or volatile alkali, and aqueous vapours, so as to produce a considerable development of heat. The whole of the mass must now be stirred, to expose the different layers of the heap to the action of the air. This operation finished, it is necessary to restore to the mass a conical or pyramidal form, and to add again a certain quantity of the solution of sal-ammoniac. The whole mass then loses its metallic character to take that of an earthy substance of a bluish colour. Salts of zinc and copper are now produced, and the chemical decomposition is terminated.

It is now necessary to dissolve this substance in sulphuric acid, diluted with water in the proportion of 20 per cent. of acid to 80 per cent. of water. I inject with this solution (by a process mentioned) the wood upon which I operate, and I decompose the preceding substance by a muriate of baryte, composed of 2 lbs. of salt with 100 lbs. of water, in the same way as in the muriate of lime above described.

The result of this combination (says the patentee) produces a metallic salt of an intensely insoluble quality, of an extreme tenacity, and of a great weight, which gives to the wood prepared by this process a character eminently impervious to water, and which makes it resist the united attacks of animalculæ and of the most destructive vegetable matter; while the price of the raw material is much less than that of any of the salts hitherto employed for the preservation of wood when used upon a large scale."

Mr. Banner gives the credit of this invention to the late Mr. Marsh, the chemist, in behalf of whose family an application was lately made to Government. We have seen a letter from Mr. Marsh, wherein, speaking of the process patented by Mr. Payne, he claims it entirely as his own. We shall be glad if this statement should strengthen the hands of those who are interesting themselves for Mrs. Marsh.

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